

Odonate Species Survey in Correlation with Air Temperature and Precipitation at Brookhaven National Laboratory

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Introduction

Odonates are large predacious winged insects, which include *Anisoptera* (dragonflies) and *Zygoptera* (damselflies). Odonates are physically characterized by long, bright colored bodies, two pairs of membranous wings, and large compound eyes. Earliest fossil records of Odonates indicate their existence approximately 300 to 325 million years ago. According to fossil records, their wingspan reached 70 to 75 centimeters long, making them one of the largest and oldest invertebrate groups ever to exist. Meteorological conditions may be a factor in the distribution of these insects. The project attempted to compare meteorological data from the summers of 2003, 2004, and 2005 and its correlation with the distribution and richness of Odonates at Brookhaven National Laboratory. The purpose of the project is to obtain accurate data that will assist in the understanding of Odonate emergence and behavior in correspondence with humidity, precipitation, and air temperature. The project utilizes weather records of the last two summers, courtesy of the Atmospheric Science Division at Brookhaven National Laboratory. Data from the past two summers of the Environmental & Waste Management Services Division at BNL are also being applied to fulfill the goal of this project, as well as current sampling and assessment of the many wetlands on the BNL site. While sampling the ponds, a new species was added to the New York State list of Odonates *Celithemis verna* or Double-Ring Pennant. Also, one of the three threatened damselflies (*Enallagma recurvatum*) was recorded for the first time at BNL this summer.



Results

During the summer of 2005, a total of 12 wetlands were assessed on site at BNL. The Ponds surveyed were P-1, P-2, P-3, P-6, P-7, P-8, P-10, P-13, P-16, P-17, Zeke's pond, and the Peconic River. Over the three years of odonate research at BNL, 53 species have been found out of 91 recorded in Suffolk County, including *Celithemis verna*, commonly known as the Double-ringed pennant, which was found for the first time at BNL this summer and is a new species record for the New York State list of Odonates. After three years of search one out of the three endangered damselfly was found in Zeke's Pond *Enallagma recurvatum* commonly known as the Pine-barrens bluet. After analysis of the weather conditions in comparison with odonate emergence, it was found that air temperature has no noticeable association with odonate emergence. Precipitation on the other hand was found to have a visible correlation with odonate emergence.

Table 4. Air Temperature 2005

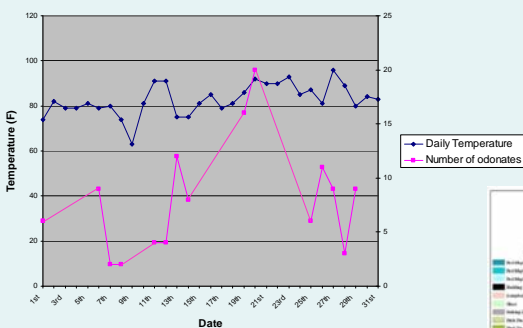
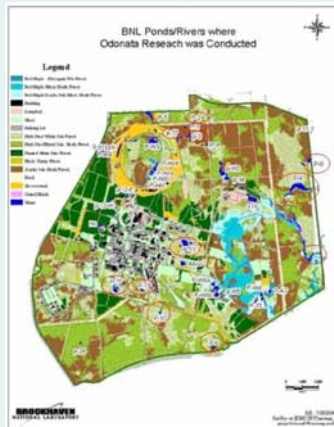


Table 1 Species Distribution Table	
Family Aeshnidae	Scientific Name
Shadow Darter	<i>Aeshna umbrosa</i>
Comet Darter	<i>Anax longipes</i>
Common Green Darter	<i>Anax junius</i>
Swamp Darter	<i>Epiacantha heros</i>
American Darter	<i>Gomphaschiza furcillata</i>
Family Corduliidae	
Williamson's Emerald	<i>Somatochlora williamsi</i>
Family Gomphidae	
Unicorn Clubtail	<i>Argonemobius villosipes</i>
Ashy Clubtail	<i>Gomphus lividus</i>
Family Libellulidae	
Calico Pennant	<i>Celithemis alita</i>
Halloween Pennant	<i>Celithemis eponina</i>
Double Ringed Pennant	<i>Celithemis verna</i>
Setwing	<i>Dytiscus</i>
Eastern Pondhawk	<i>Erythemis simplicicollis</i>
Bar-winged Skimmer	<i>Libellula axilana</i>
Spangled Skimmer	<i>Libellula cyanea</i>
Blue Concord	<i>Libellula depressa</i>
Blat Skimmer	<i>Libellula incesta</i>
Widow Skimmer	<i>Libellula lucasana</i>
Common Whitetail	<i>Libellula lydia</i>
Twelve-Spotted Skimmer	<i>Libellula pulchella</i>
Painted Skimmer	<i>Libellula semifasciata</i>
Great Blue Skimmer	<i>Libellula vibrans</i>
Blue Dasher	<i>Pachydiplax longipennis</i>
Wandering Glider	<i>Pantala flavescens</i>
Spot-winged Glider	<i>Pantala hymenaea</i>
Eastern Amberwing	<i>Perithemis tenera</i>
Cherry-Faced Meadowhawk	<i>Sympetrum internum</i>
White-faced Meadowhawk	<i>Sympetrum obtrusum</i>
Ruby Meadowhawk	<i>Sympetrum rubicundulum</i>
Blind-winged Meadowhawk	<i>Sympetrum semicinctum</i>
Carolina Saddlebags	<i>Tramea carolina</i>
Black Saddlebags	<i>Tramea lacerata</i>
Damselflies	
Family Calopterygidae	
Ebony Jewelwing	<i>Calopteryx maculata</i>
Family Coenagrionidae	
Variable Dancer	<i>Argia fumipennis violacea</i>
Acute Bluet	<i>Enallagma asperum</i>
Familiar Bluet	<i>Enallagma civile</i>
Northern Bluet	<i>Enallagma cyathigerum</i>
Atlantic Bluet	<i>Enallagma doubledayi</i>
Big Bluet	<i>Enallagma ebrium</i>
Marsh Bluet	<i>Enallagma ebrium</i>
Skimming Bluet	<i>Enallagma geminatum</i>
Pine Barrens Bluet	<i>Enallagma recurvatum</i>
Citrine Forktail	<i>Ischnura hastata</i>
Fragile Forktail	<i>Ischnura posita</i>
Rambur's Forktail	<i>Ischnura ramburii</i>
Eastern Forktail	<i>Ischnura verticalis</i>
Sphagnum Sprite	<i>Nehalennia gracilis</i>
Family Lestidae	
Spotted Spreadwing	<i>Lestes conjugens</i>
Common Spreadwing	<i>Lestes disjunctus disjunctus</i>
Amber-winged Spreadwing	<i>Lestes auritus</i>
Sweetflag Spreadwing	<i>Lestes forficatus</i>
Elegant Spreadwing	<i>Lestes inaequalis</i>
Slender Spreadwing	<i>Lestes rectangularis</i>
Lyre-tipped Spreadwing	<i>Lestes unguiculatus</i>
Swamp Spreadwing	<i>Lestes vigilans</i>
New species found in 2005	<i>NY threatened species</i>
	<i>New NY Record</i>

Table 3



Materials and Methods

In order to collect adult Odonates a 15" net was used to catch insects while they were in flight or perched on vegetation. Chest waders were worn while wading in or around the ponds where odonates could be found. A pair of 10 x 50 Burreis signature series binoculars was used to observe odonate behavior. Once the specimens were caught they were placed in glassine envelopes and then placed in a Tupperware jar where they were kept alive to preserve their vibrant coloration. A digital camera was used to take pictures of the insects in their natural environment.

Lab work was conducted with the aid of a variety of tools and materials, including a 7-25x Bausch & Lomb dissecting microscope to magnify the sections and features of the insect, dissecting tweezers and a gel filled Petri dish, to examine the sample. Each insect was first cooled to slow down its metabolism and prevent color fading prior to examination. Once the specimen was identified and its information recorded the insect was immediately immersed in acetone for 24 hours to dehydrate and to dissolve its body fat. After the 24 hour process they were removed from the acetone, dried for an hour and stored in a file box.

Air temperature, humidity, and precipitation were recorded daily and analyzed with odonate emergence. Correlating data from the summers 2003, 2004 and 2005 to compare results.

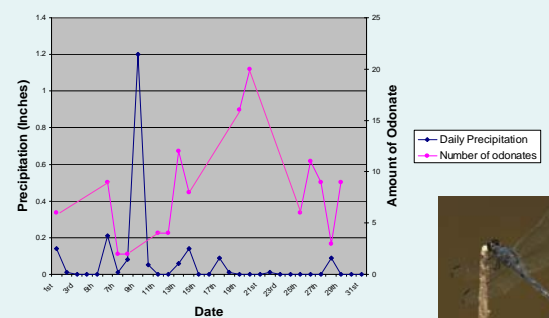
DISCUSSION

The purpose of the Odonate research of the summer of 2005 was to obtain accurate data that would assist in the understanding of the insects' emergence and behavior in correspondence with precipitation, and air temperature. Also, to continue with the identification and survey of the species found at Brookhaven National Laboratory, and to continue the search for the three threatened damselflies in the New York State list of threatened and endangered species.

A total of twelve wetlands were surveyed during the summer of 2005 (as shown in Table 3). To date a total of 53 odonate species have been recorded at BNL, nine of those species were found in the summer of 2005, including one of the three threatened damselfies *Enallagma recurvatum*, and *Celithemis verna* or the Double-ringed pennant which was found during the summer of 2005 at BNL and is a first time record for New York State.

After analyzing the weather data obtained from the National Weather Service, located at BNL, it was found that between air temperature and odonate emergence there is no visible correlation (as shown in Table 4), although there was a relationship between the number of odonate individuals found when the air temperature rose from about 80° F and the humidity reached above 75%. In contrast, the precipitation charts indicate a correspondence between precipitation and emergence (as shown in table 2). Days after either a high or low point in precipitation, the level of odonate emergence increased significantly. Showing that the presence/absence of rain affects the emergence and mating of the insects, although future research is needed to obtain precise answers for this apparent connection.

Table 2 2005 Precipitation



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